

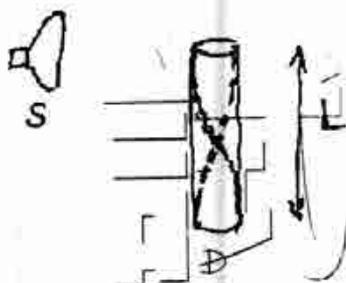
考生注意：1. 依次序作答，只要標明題號，不必抄題。

2. 答案必須寫在答案卷上，否則不予計分，並限以藍黑色筆作答。

3. 試題隨卷繳回。(餘詳詳閱試場規則)

- [20pts] Six particles, each with mass M , trapped in a two-dimensional infinite potential well with width $L_x = L_y = L$. There are no special interactions between the particles —no significant mutual electrostatic repulsion, gravitational attraction, etc., compared to the strength of their interaction with the harmonic potential itself. Remember that the energy levels of a particle in box are $E_{n_x, n_y} = \frac{h^2}{8mL^2} (n_x^2 + n_y^2)$. Assume that the system is in its ground state. i.e., $T=0$ Kelvin. Calculate the total energy E , for the case
 - The particles are distinguishable.
 - The particles are identical bosons.
 - The particles are identical spin 1/2 fermions.

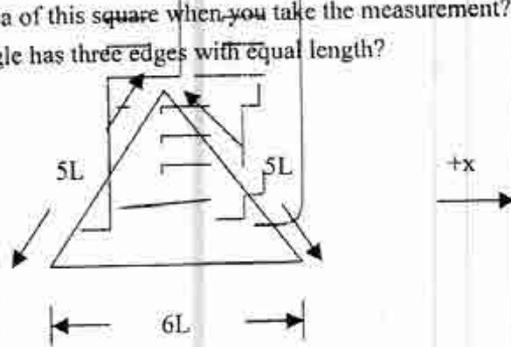
- [20pts] As shown in the figure below, S is a small loudspeaker driven by an audio oscillator and amplifier, adjustable in frequency from 1000 to 2000 Hz only. Tube D is a metal pipe 51.5 cm long and open at both ends. (a) If the speed of sound in air is 344 m/s at the existing temperature, at what frequencies will resonance occur in the pipe when the sound with frequency f emitted by the speaker is varied from 1000 Hz to 2000 Hz? (b) Sketch the standing wave (using the same style as the figure below) for each resonance frequency.



- [20pts] In a 1911 paper, E. Rutherford said: "In order to form some idea of the forces requires to deflect an α particle through a large angle, consider an atom [as] containing a point positive charge Ze at its center and surrounded by a distribution of negative electricity $-Ze$ uniformly distributed within a sphere of radius R . The electric field E ... at a distance r from the center for a point inside the atom [is] $E = \frac{Ze}{4\pi\epsilon_0} \left(\frac{1}{r^2} - \frac{r}{R^3} \right)$ " Verify this equation.
- [20pts] Select what you think is correct answers inside the parenthesis, and write them down. Noted that sometimes there is more than one right answer.
 - a reversible process is one that proceeds by a succession of very small incremental steps, all of which are at (equilibrium, spontaneous,

- 考生注意：1. 依次序作答，只要標明題號，不必抄題。
 2. 答案必須寫在答案卷上，否則不予計分，並限以藍黑色筆作答。
 3. 試題隨卷繳回。(除詳閱試場規則)

- enthalpically driven, entropically driven).
- b. ($\Delta H, \Delta S, \Delta G, \Delta E$) implies constant pressure.
- c. When a sample of liquid is converted reversibly to its vapor at its normal boiling point, ($q, w, \Delta P, \Delta V, \Delta E, \Delta H, \Delta S, \Delta G, \Delta T$) is equal to zero for the system.
- d. An ideal gas expands adiabatically into a vacuum. ΔE for the system is (greater than zero, equal to zero, less than zero).
5. [20pts] As shown in the figure below, a triangle, with lengths of edges as 5L, 5L and 6L, moves in +x direction with speed 0.5 c (speed of light) respect to you. What is the area of this square when you take the measurement? At which speed, does this triangle has three edges with equal length?



試

題